

## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY



(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference ASPE1PCT	<b>FOR FURTHER ACTION</b>		See Form PCT/IPEA/416
International application No. PCT/FI2004/000382	International filing date (day/month/year) 23.06.2004	Priority date (day/month/year) 25.06.2003	
International Patent Classification (IPC) or national classification and IPC H04R7/02			
Applicant ASPERATION OY et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  25.04.2005		Date of completion of this report  29.11.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Coda, R  Telephone No. +49 89 2399-2802 	

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/FI2004/000382

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**Box No. I Basis of the report**

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1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-12 as originally filed

**Claims, Numbers**

1-18 filed with telefax on 17.11.2005

**Drawings, Sheets**

1/8-8/8 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/FI2004/000382

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	3, 10, 14, 17
	No: Claims	1, 2, 4-9, 11-13, 15, 16, 18
Inventive step (IS)	Yes: Claims	
	No: Claims	3, 10, 14, 17
Industrial applicability (IA)	Yes: Claims	1-18
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

1. Reference is made to the following documents:

D1: WO 97 39464 A1

D3: US-A-5 982 709

2. The subject-matter of claims 1, 2, 4 to 9, 11 to 13, 15, 16 and 18 is not new (Art. 33(2) PCT).

2.1 As far as the general disclosure of D1 is concerned, it is noted that D1 describes the possibility of creating an electromechanical transducer, composed of a multiplicity of units like the one disclosed in figure 3 (see page 15, lines 10 to 12). In this case, multiple microphones are located on a common substrate wafer (see page 15, lines 20, 21) to create a microphone, i.e. an electromechanical transducer, for a portable telecommunication device. Therefore, the common back plate discloses an array of parallel vibrators.

With respect to the amended independent claim 1, D1 discloses in particular a membrane arranged, with the aid of support structures against one of the electrodes, which is relatively rigid, so that vibration mainly takes place in the vibrating membrane, while the said electrode remains essentially immobile (see page 8, lines 16 to 20; figure 3).

Moreover, D1 discloses an electromechanical transducer for converting sound energy into an electric signal, with a membrane (see page 4, lines 6 to 10), two electrodes (see page 5, line 19; page 8, lines 16 to 20; figure 3(4, 15, 30, 32)), the electric field between which can be controlled or measured, and a support structure, on which the membrane is arranged to vibrate, interacting with the electric field (see page 9, lines 18 to 21), and which support structure includes several support points, which are positioned in such a way that several parallel vibrators are formed in the membrane, wherein the support structure is formed as a permanent part of the membrane (see page 15, lines 11 to 15).

Therefore, the subject-matter of amended claim 1 is not new.

2.2 As far as the general disclosure of D3 is concerned, it is noted that D3 describes a transducer with a continuous membrane, i.e. a transducer in which the membrane is not disturbed by openings (see column 5, lines 19 to 22). Therefore, also the document D3 discloses a transducer according to the amended claim 1 (see column 1, lines 10, 19 to 28; column 4, lines 23 to 35, 40, 41, 54 to 59, 66, 67; column 6, lines 28 to 31).

Therefore, the subject-matter of claim 1 is not new also with respect to D3.

2.3 It is noted that the independent method claim 12 corresponds to independent claim 1 in that for every structural feature of the characterising portion of claim 12 a corresponding method step is defined therein.

Moreover D1 discloses the steps of :

- manufacturing a combination piece, which includes the first electrode, the membrane, and the support structure of the membrane (see page 8, lines 16 to 20);
- charging the membrane after the manufacture of the combination piece (see page 5, lines 14, 15; page 6, lines 20, 21).

Therefore with respect to document D1 also the subject-matter of amended independent claim 12 is not new.

2.4 The dependent claims 2, 4 to 9, 11, 13, 15, 16 and 18 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty:

- claims 2, 4, 5: D1 discloses the cavities (see figure 3), the channels (see page 8, lines 24, 25) and the fixed structure (see page 8, lines 8 to 11);
- claims 6, 11, 15, 18: D1 discloses the permanently charged electromechanical insulating membrane (see page 5, lines 3, 14, 15; page 6, lines 20, 21);
- claims 7 to 9, 13: D1 discloses the gluing (see page 8, lines 19, 20) and the electrode formed on a surface of the membrane (see page 5, line 19; figure 3);
- claim 16: D1 discloses the method of manufacturing (see point 1.1 and figure 3).

3. The dependent claims 3, 10, 14 and 17 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT):
  - claims 3, 10: the use of these cavities and the manufacturing on the surface of the device case are merely one of several straightforward possibilities from which the skilled person would select, without the exercise of inventive skill, in order to improve the system reliability;
  - claims 14, 17: the use of a pre-tension is a normal design procedure for the skilled person in order to improve the system reliability (see the document D3, column 4, lines 40, 41).
4. The application does not meet the requirements of Article 6 PCT, because amended claims 1 and 3 are not clear.
  - 4.1 The following feature:
    - "*the support structure is formed as a permanent part of the membrane*" in the apparatus claim 1, lines 9, 10 relate to a method of using the apparatus rather than clearly defining the apparatus in terms of its technical features. The intended limitations are therefore not clear from this claim, contrary to the requirements of Article 6 PCT.
  - 4.2 The term "*essentially the same size*" used in claim 3, line 21, is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition of the subject-matter of said claim unclear, Article 6 PCT.
5. It is noted that the embodiments described in figures 1A, 1B and 2 are not covered by claim 1 (see PCT Guidelines, Part II, para. 5.29)



**Claims:**

1. An electromechanical transducer for converting sound energy into an electric signal, or vice versa, which transducer includes a membrane (3), two electrodes (1, 2), the electric field between which can be controlled or measured, and a support structure (4, 5), on which the membrane (3) is arranged to vibrate, interacting with the electric field, and which support structure (4, 5) includes several support points (4, 5), which are positioned in such a way that several parallel vibrators are formed in the membrane (3), wherein the membrane (3) is arranged, with the aid of the support structure (4, 5), against one of the electrodes (1, 2), which is relatively rigid so that vibration mainly takes place in the vibrating membrane, while the said electrode remains essentially immobile, characterized in that the support structure (4, 5) is formed as a permanent part of the membrane (3).
2. A transducer according to Claim 1, characterized in that the support structures (4, 5) and the electrodes (1, 2) delimit cavities (8) for the parallel vibrators on both sides of the membrane (3), so that the membrane (3) can vibrate in both directions from its rest position.
3. A transducer according to Claim 2, characterized in that at least some of the cavities (8) are located essentially opposite to each other on both sides of the membrane (3), so that the transducer includes several vibrators, which are able to vibrate in two directions from the rest position of the membrane (3), in such a way that the vibrating surface area of the membrane (3) is essentially the same size and at the same point in the membrane (3), when the vibrator vibrates in the first direction and in the second direction.
4. A transducer according to Claim 2 or 3, characterized in that at least one opening or channel (7) is connected to each cavity (8), by means of which the internal space of the cavity (8) is in a pressure-equalization connection with the air space outside the transducer, or at least with some other cavity (8).
5. A transducer according to any of Claims 1 - 4, characterized in that at least one electrode (1) forms a fixed structure, to which the moving membrane (3) is fitted, so that the membrane and the electrode (1) are in contact with each other only through the

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support structures (4, 5).

6. A transducer according to any of Claims 1 - 5, characterized in that the membrane is a permanently charged electromechanical insulating membrane, the thickness of which remains essentially the same when the membrane vibrates.

7. A transducer according to any of Claims 1 - 6, characterized in that the support structure (4, 5), the membrane (3), and the first electrode (1) are permanently attached together to form one piece, for example, by gluing or welding, and this piece is set or pressed against the second electrode (2).

8. A transducer according to any of Claims 1 - 8, characterized in that one of the electrodes (1) is manufactured on the surface of the membrane (3).

9. A transducer according to any of Claims 1 - 8, characterized in that the membrane (3) includes a support structure (4, 5) only on one side of the membrane (3).

10. A transducer according to any of Claims 1 - 9, characterized in that the transducer is attached as part of the device case and that the first electrode (1) is manufactured on the surface of the membrane (3), and the second electrode (2) is manufactured on the surface of the device case.

11. A transducer according to any of Claims 1 - 10, characterized in that the membrane (3) is a permanently charged electromechanical insulating membrane.

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12. A method for manufacturing an electromechanical transducer, which transducer includes a membrane (3), two electrodes (1, 2), the electric field between which can be controlled or measured, and a support structure (4, 5), on which the membrane (3) is arranged to vibrate, interacting with the electric field, and wherein the membrane (3) is arranged, with the aid of the support structure (4, 5), against one of the electrodes (1, 2), which is relatively rigid so that vibration mainly takes place in the vibrating membrane, while the said electrode remains essentially immobile, in which method:

- the support structure (4, 5) is formed in such a way that it includes several



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support points (4, 5) at a distance from each other, and

- the membrane (3), the electrodes (1, 2), and the support structure (4, 5) are positioned in such a way that several parallel vibrators are formed in the membrane (3),

5     **characterized in that**

- a combination piece is manufactured, which includes the first electrode (1), the membrane (3), and the support structure (4, 5) of the membrane (3), and
- after the manufacture of the combination piece, the membrane (3) is charged with an electrical charge.

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13. A method according to Claim 12, **characterized in that** the first electrode (1) is formed on the surface of the membrane (3).

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14. A method according to Claim 12 or 13, **characterized in that** the membrane (3) is stretched to a pre-tension before the attachment of the membrane.

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15. A method according to any of Claims 12 - 14, **characterized in that** the membrane (3) is an electromechanical insulating membrane (3), to which a permanent electrical charge is brought when the membrane is charged.

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16. A method according to Claim 12, **characterized in that** the manufacture of the combination piece comprises:

- taking an electrode (1),
- taking a membrane (3),
- taking a support structure (4), which is either a separate support structure (4) or is permanently attached to the electrode (1) or the membrane (3),
- attaching the electrode (1), the membrane (3), and the support structure (4) to each other, in such a way that the membrane (3) is at least partly located at a distance from the electrode (1), and
- charging the attached membrane (3) with an electrical charge.

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17. A method according to Claim 16, **characterized in that** the electrode (1), the membrane (3), and the support structure (4) are attached to each other, in such a way that

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the membrane (3) receives a specified pre-tension.

18. A method according to Claim 16 or 17, characterized in that the membrane (3) is an electromechanical insulating membrane (3), to which a permanent electrical charge is brought when charging the membrane.